Mongooses on the move: an apparent case of interspecific cooperative vigilance between carnivores

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Meerkats (*Suricata suricatta*) and yellow mongooses (*Cynictis penicillata*) show antipredator behaviours which, at least in the former species, can take the form of cooperation between pack members. Here, we describe an apparent case of cooperative vigilance between one yellow mongoose and three meerkats while the animals were travelling in open terrain from one termite mound to another. We hypothesize that the observed interspecific interaction, although enabled by similarities in the behaviour of both herpestid species, might have been favoured by the shared use of burrows leading to interspecific tolerance and the high predation pressure put on small groups. To our knowledge, this would constitute the first reported instance of cooperation between two carnivore species related to predator detection.

Key words: cooperative vigilance, interspecific group augmentation, interspecific tolerance, predation pressure, shared use of burrows.

Meerkats (*Suricata suricatta*) and yellow mongooses (*Cynictis penicillata*) are small diurnal members of the family Herpestidae which live in sympatry in most areas of their southern African geographic distribution (Stuart & Stuart 2001). These semi-fossorial carnivores occasionally share burrows for their nocturnal resting period (Lynch 1980). This led Lynch (1980) to propose that this close association between the two species may benefit yellow mongooses *via* improved predator detection, although he did not describe any such interspecific group vigilance or defence. Both species may form large groups and show a typical vigilance posture, which consists of standing on their hind legs, sometimes referred as 'high-sit' (Estes 1991). In meerkats, antipredator behaviour can clearly occur in the form of cooperation between pack members (Clutton-Brock *et al.* 1999b). One or more individuals act alternately as sentinels while the other group members move and forage (Dennis & Macdonald 1999). In yellow mongooses, colony members generally forage individually or in pairs, but communal foraging and a form of cooperative vigilance have been recorded in one unpublished study (Z. Balmford, pers. comm., 2006). Here, we report for the first time a case of apparent interspecific cooperative vigilance involving one yellow mongoose and three meerkats.

The observations were made in the Andries Vosloo Kudu Reserve, Eastern Cape Province, South Africa, a 6500 ha conservation area which constitutes the eastern part of the Great Fish River Reserve, and is located between 33°04′ and 33°09′ S and 26°37′ and 26°49′ E, 35 km north-east of Grahamstown. The vegetation in the reserve is essentially composed of a semi-succulent thorny thicket, about 2–3 m high, classified by Acocks (1988) as valley bushveld, but recently renamed as xeric succulent thicket (Low & Rebello 1996). The visual observations related below were made from a car, by naked eye or using binoculars (Swarowski, Model EL 8.5 × 42 mm). Although not purposely habituated, mongooses paid little attention to the vehicle (situated between 20 and 100 m from the animals) and did not appear to have been influenced by the researcher's presence.

Direct observations in the mornings and evenings of the whole September month 2005 revealed that one adult female yellow mongoose ('Thendiswa') used at least two burrows (dug in termite mounds, and hereafter referred as 'Burrow A' and 'Burrow D') with an adult male ('Brown'). In the mornings, both individuals could be observed leaving their shelter to forage, either solitarily or as a pair, whereas in the evenings, animals always joined the warren individually (in some cases the two animals denned in different burrows). A third, unsexed adult-sized yellow mongoose ('Light'), was also observed using Burrows A and D. Nevertheless, it seemed to be only 'loosely' associated with the pair. On some occasions, a small group of three meerkats was observed to also den in Burrows A and D, when these were already occupied by at least two yellow mongooses. Meerkats were always seen leaving and joining the nocturnal resting site as a cohesive unit.

On 9 September 2005 the first author witnessed an unexpected interaction between Light and the three meerkats. At 09:20, one meerkat emerged from Burrow A, immediately followed by Light and

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the two other meerkats (Location 1 in Fig. 1). All four individuals remained close to one another while sun-bathing. At 09:35, Brown was observed independently feeding, about 40 m southeast of Burrow A (Location indicated by a star in Fig. 1). At 09:45, the three meerkats left Burrow A, heading to the west. After some seconds of apparent hesitation, Light joined the three meerkats at Location 2, holding the last position. While the third meerkat then took a rear-guarding post on a small termite mound (Location indicated by a cross in Fig. 1), the yellow mongoose followed the two leading meerkats to Location 3. At 09:46, all four individuals were vigilantly standing in the middle of the karroid scrub. Light was standing an estimated 20–30 cm away from the second meerkat. At that stage, the yellow mongoose lead the group, successively reaching Location 4 (where no animal stood) and Location 5 (where only Light stood). One meerkat then headed directly to Burrow D (Location 7), adopting a high-sit posture, whereas Light and a second meerkat stopped at Location 6, both standing side by side (Light this time preceding the meerkat by some 20–30 cm). At 09:48, all individuals had reached burrow D, again engaging in high levels of vigilance behaviour, before eventually disappearing behind the dense bushes fringing the southern part of the termite mound (move indicated by arrow 8 in Fig. 1).

Mongooses in general are opportunistic and known to routinely take advantage of the presence of other species to minimize predation risk (*e.g.* dwarf mongooses (*Helogale parvula*) foraging with hornbills: Rasa 1983; meerkats and ground squirrels (*Xerus inauris*) foraging in close proximity of one another and reacting to each other's alarm calls: Z. Balmford, pers. comm., 2006). Nevertheless, the behavioural sequence related above is unique in the literature in the sense that it concerns two mongoose species. Furthermore, although mixed species groups are well known (see Caro 2005 for a review), we found no record of cooperation with regard to vigilance between carnivores.

With a single observation, it is difficult to affirm that the interaction was a 'purposeful' attempt by one or/and other species to minimize predation risks through cooperative vigilance, rather than a 'passive' association (and possibly mutually beneficial) brought about by both species instinctively following and catching up with conspecifics that move away (Ewer 1973; Z. Balmford, pers. comm., 2006). Nevertheless, if the latter explanation is correct, we would expect such 'catch-up' interactions to occur relatively frequently in the two species which inhabit overlapping distributional ranges, and exploit the same (open to semi-open) feeding areas by daylight. However, no such interspecific interaction has previously been reported, even within the framework of long-term observational studies in the Kalahari involving numerous groups of meerkats and yellow mongooses (A.J. Young, pers. comm., 2006; A. Le Roux, pers. comm., 2006).

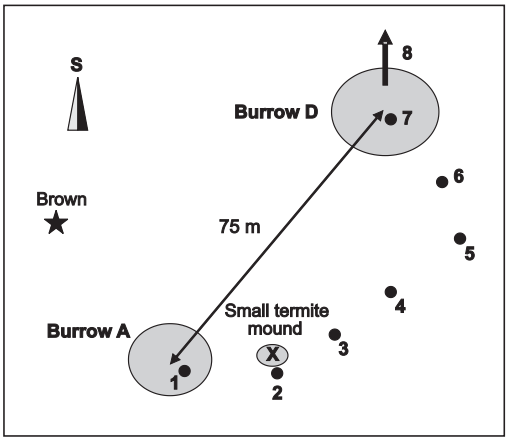

Fig. 1. Schematic representation of the observation site and of the behavioural sequence described in the text.

We therefore suggest that small group size in both meerkats and yellow mongooses (only three individuals in each case) might have directly encouraged – even if only on a temporary basis – cooperation to augment the group. Group augmentation theory (*e.g.* Kokko *et al.* 2001) proposes that individual group members benefit directly from a larger group size (*via* improved vigilance or thermoregulation, for example). The present situation may well be a case of interspecific group augmentation. Field studies on meerkats have shown that a larger group size probably increases the efficiency of predator detection in areas with a high density of predators, because mortality rate is negatively correlated with group size (Clutton-Brock *et al.* 1999a). Similar results have been found in studies on dwarf mongooses (Rasa 1987a,b; Rood 1990). As meerkats and yellow mongooses have the same spectrum of predators (Taylor & Meester 1993; van Staaden 1994), cooperation of the yellow mongoose could have slightly increased the overall chances of detecting potential predators for both species. That the one yellow mongoose did not follow the meerkats suggests that the benefits (if any) of following are not that

large that all yellow mongooses follow meerkats at every opportunity. This reasoning leads to the prediction that this kind of cooperative behaviour is less likely to occur when group size is large, because group members already profit from the vigilance of numerous conspecifics. Our prediction seems to be confirmed by the absence of apparently cooperative interactions in the studies from the Kalahari, where group sizes are moderate to high (Clutton-Brock *et al.* 1999a,b). Actually, animals of both species seem to ignore each other completely while foraging, whereas at the burrows interactions are usually more aggressive (A. Le Roux, pers. comm., 2006).

In conclusion, we propose that the interspecific interaction described in this paper, although ultimately enabled by behavioural similarities shared by both mongoose species, was probably favoured by a high degree of interspecific tolerance emerging through the shared use of burrows and the higher predation risks associated with living in small groups.

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REFERENCES

ACOCKS, J.P.H. 1988. Veld types of South Africa. *Mem. Bot. Surv. S. Afr.* 57: 1–146.

CARO, T. 2005. Antipredator defenses in birds and mammals. University of Chicago Press, Chicago.

CLUTTON-BROCK, T.H., GAYNOR, D., MCILRATH, G.M., MACCOLL, A.D.C., KANSKY, R., CHADWICK P., MANSER, M., SKINNER, J.D. & BROTHERTON, P.N.M. 1999a. Predation, group size and mortality in a cooperative mongoose, *Suricata suricatta. J. Anim. Ecol.* 68: 672–683.

CLUTTON-BROCK, T.H., O'RIAIN, M.J., BROTHERTON, P.N.M., GAYNOR, D., KANSKY, R., GRIFFIN, A.S. & MANSER, M. 1999b. Selfish sentinels in cooperative mammals. *Science* 284: 1640–1644.

DENNIS, N. & MACDONALD, D.W. 1999. Meerkats. New Holland, London.

ESTES, R.D. 1991. The behavior guide to African mammals. University of California Press, Berkeley.

EWER, R.F. 1963. The behavior of the meerkat, *Suricata suricatta* (Schreber). *Z. Tierpsychol.* 34: 359–394.

KOKKO, H., JOHNSTONE, R.A. & CLUTTON-BROCK, T.H. 2001. The evolution of cooperative breeding through group augmentation. *Proc. R. Soc. Lond. B* 268: 187–196.

LOW, A.B. & REBELLO, A.G. 1996. Vegetation of South Africa, Lesotho and Swaziland. Department of Environment Affairs and Tourism, Pretoria.

LYNCH, C.D. 1980. Ecology of the suricate, *Suricata suricatta* and the yellow mongoose, *Cynictis penicillata* with special reference to their reproduction. *Mem. Nas. Mus., Bloemfontein* 14: 1–145.

RASA, O.A.E. 1983. Dwarf mongoose and hornbill mutualism in the Taru Desert, Kenya. *Behav. Ecol. Sociobiol.* 12: 181–190.

RASA, O.A.E. 1987a. Vigilance behaviour in dwarf mongooses: selfish or altruistic? *S. Afr. J. Sci.* 83: 587–590.

RASA, O.A.E. 1987b. The dwarf mongooses: a study of behaviour and social structure in a small social carnivore. *Adv. Stud. Behav.* 92: 393–398.

ROOD, J.P. 1990. Group size, survival, reproduction and routes to breeding in dwarf mongooses. *Anim. Behav.* 39: 566–572.

STUART, C. & STUART, T. 2001. Field guide to mammals of southern Africa. Struik Publishers, Cape Town.

TAYLOR, P.J. & MEESTER, J. 1993. *Cynictis penicillata. Mammalian Species* 432: 1–7.

VAN STAADEN, M.J. 1994. *Suricata suricatta. Mammalian Species* 483: 1–8.

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